

LANGLEY PROGRAM OF GaAs SOLAR CELLS

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The Langley Research Center program on GaAs solar cells began in the early 1970's. Its objectives were to develop the technology for (a) 18- to 20-percent AMO efficiency, (b) stability under radiation and elevated-temperature operation, and (c) high power-to-weight ratio. To achieve the efficiency objective, we focused most of our effort on the original heteroface cell. With the achievement of 18-percent cells, the program of grants, contracts, and in-house research was broadened to include (fig. 1) radiation stability, operation at elevated temperature, thin cells, and costs.

The radiation stability research program has three elements:

(1) Device and material damage studies: The effects of proton irradiation on GaAs cells is investigated at Hughes Research Laboratory (HRL). More fundamental measurements on the effects of proton irradiation on cell materials (i.e., n-GaAs, p-GaAs, etc.) are made at the University of Florida. Electron damage of cells is performed in-house. The cells are grown at Langley, irradiated at Lewis, and characterized at Langley.

(2) Annealing studies: Annealing of cells after degradation by 1-MeV-electron irradiation is studied in-house. General parameters studied so far include annealing temperature and time, total fluence, and junction depth. University of Florida studies involve the use of deep-level transient spectroscopy to follow proton damage annealing.

Operation of GaAs cells at elevated temperature is studied through closely coordinated research at the Old Dominion University and at Langley. A series of measurements and analyses of cell characteristics at temperatures to 350° C are in progress.

Thin cells offering high power-to-weight ratio are a very new program element. Some preliminary investigations will be performed at IBM by using CVD techniques. A novel approach, deposition of GaAs and GaAlAs from molten salts, is being investigated at the University of Southern California.

Cell cost and availability appear to be major problems for utilization of GaAs solar cells. A short-term study by A. D. Little, Inc., seeks to define the cost and availability problems and potential solutions for the early 1980's. The final report will be available late this summer.

In summary, Langley has a small, research-oriented program on GaAs solar cells. Our emphasis is on assessing the potential and stimulating the development of technology for these cells.

OVERVIEW OF LaRC PROGRAM
ON GaAs SOLAR CELLS

1. Radiation Stability
 - a. Device and Material Damage Studies - LaRC, HRL, U of Fla.
 - b. Annealing Studies - LaRC, U of Fla.
 - c. Device Optimization by LPE and CVD - LaRC
2. High Temperature Operation
 - a. Device Studies - ODU, LaRC
3. Thin Film Cells
 - a. Thick and Thin Cells - IBM
 - b. Electrodeposition - U. S. C.
4. Processing Technology
 - a. Study - A. D. Little

Figure 1.